Announcements

- Homework for tomorrow…

    (Ch. 26, CQ 3, Probs. 8 & 36)

CQ12: 

25.22: q = 1.1 x 10^{-10} C
25.60: see handout
25.66: q = 1.8 x 10^{-7} C

Office hours…

MW 10-11 am
TR 9-10 am
F 12-1 pm

- Tutorial Learning Center (TLC) hours:

MTWR 8-6 pm
F 8-11 am, 2-5 pm
Su 1-5 pm

Chapter 26

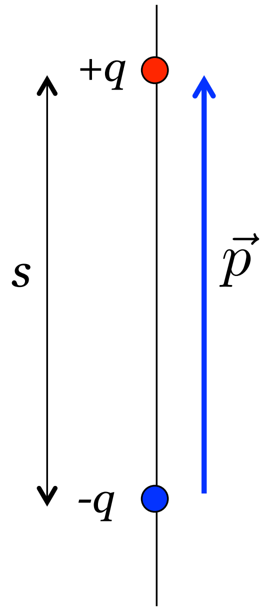
The Electric Field

(*The E-Field of a Continuous Charge Distribution*)

Last time…

- *Dipole Moment…*

$$\boxed{\vec{p} = qs, \text{ from the - to + charge}}$$



- *E-field* of a dipole on the *dipole axis…*

$$\boxed{\vec{E}_{dipole} \simeq \frac{1}{4\pi\epsilon_0}\frac{2\vec{p}}{r^3}} \qquad \text{when } r \gg s$$

- *E-field* of a dipole in the *bisecting plane…*

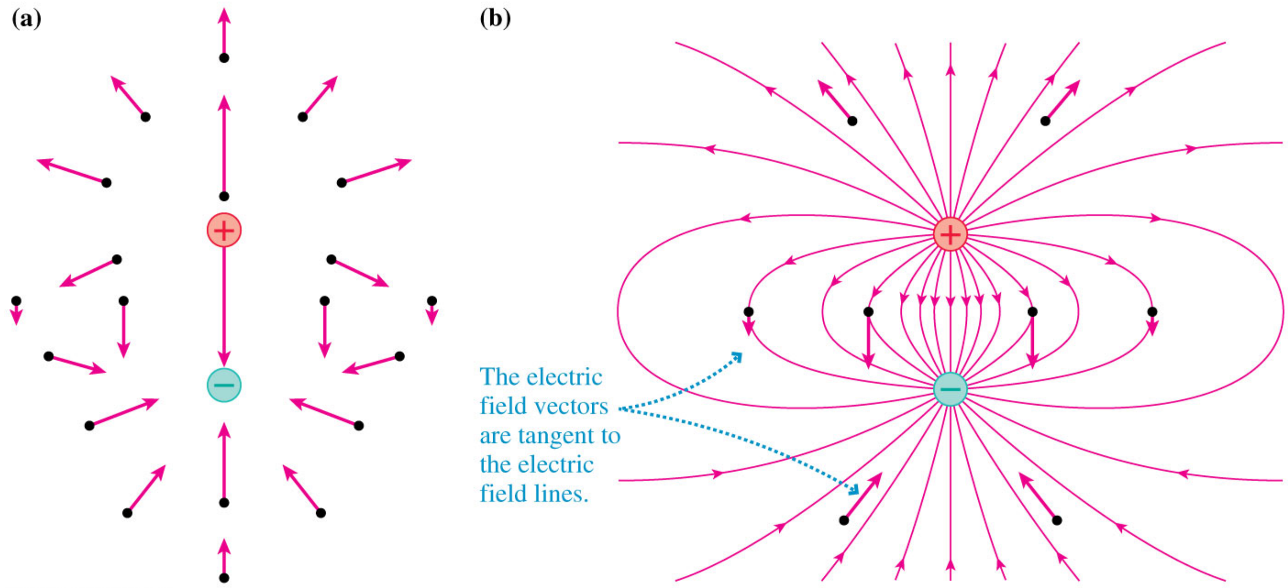
$$\boxed{\vec{E}_{dipole} \simeq -\frac{1}{4\pi\epsilon_0}\frac{\vec{p}}{r^3}} \qquad \text{when } r \gg s$$

Notice: r is distance measured from the *center* of dipole.

Picturing the E-Field…

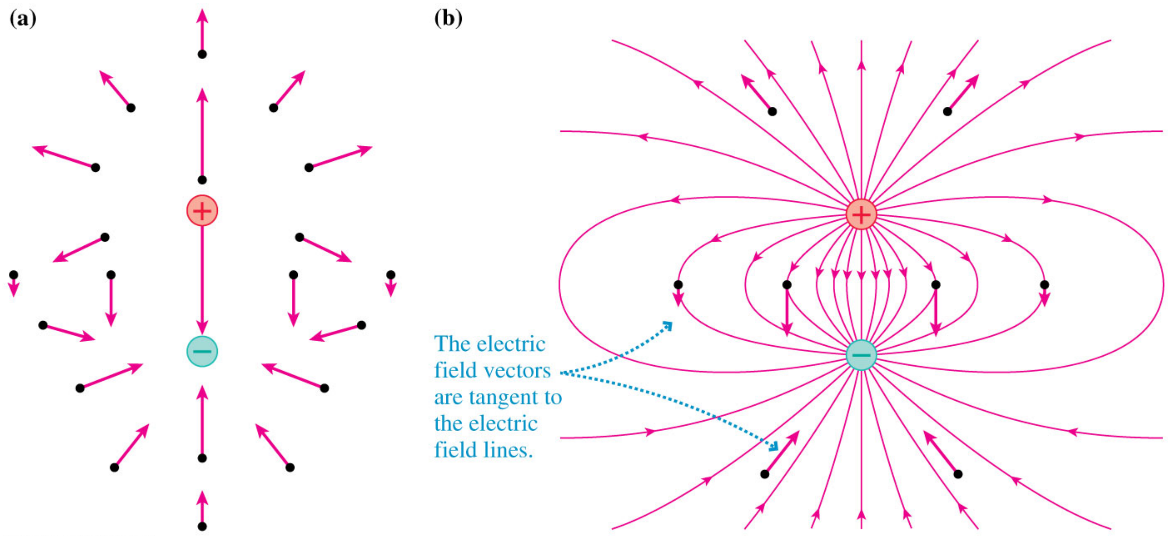
Two ways:

1. *Electric field vectors*
2. *Electric field lines*



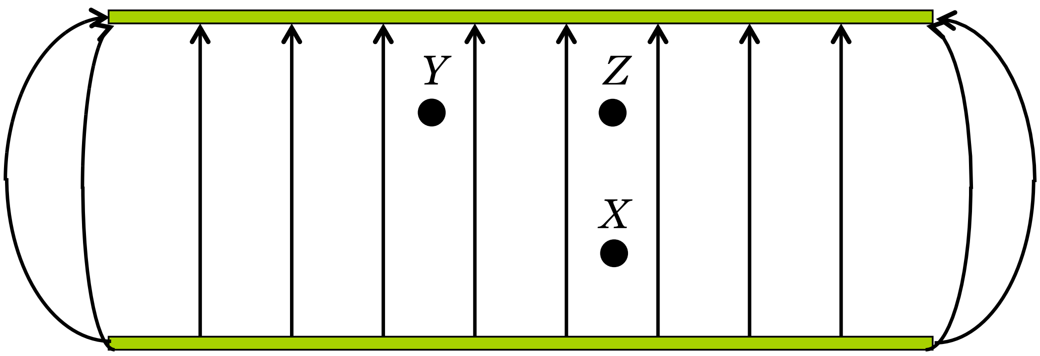
Electric Field Line Rules:

1. Lines start on + charges and end on – charges.
2. As lines get *closer*, fields get *stronger*.
3. Arrows point in direction of force on a *positive test charge*.
4. Force is *tangent* to field lines.
5. Field lines CAN'T cross.



Quiz Question 1

The diagram shows the electric field lines due to two charged metal plates. We can conclude that:



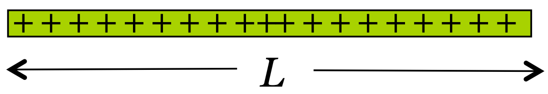
1. The upper plate is *positive* and the lower plate is *negative*.
2. A + charge at *X* would experience the *same* force if it were placed at *Y* or *Z*
3. A + charge *X* experiences a *greater force* than if it were placed at *Y* or *Z*.
4. A + charge at *X* experiences *less force* than if it were placed at *Y* or Z.
5. A - charge at *X* could have it's weight balanced by the electrical force.

Charge Densities

Point Charge

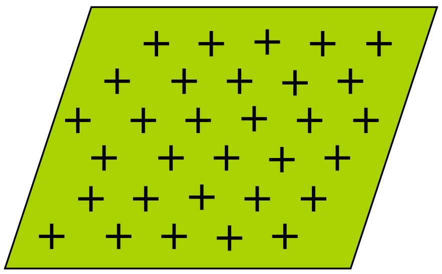
q

Line Charge



$$\lambda = \frac{Q}{L}$$

Surface Charge

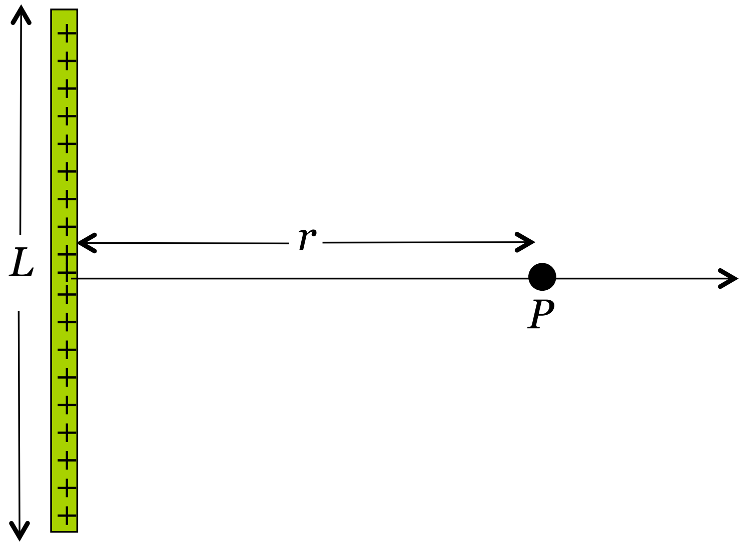


Area A

$$\eta = \frac{Q}{A}$$

i.e. 26.3
E-field of a line of charge..

Figure 26.11 shows a thin, uniformly charged rod of length L with total charge Q. Find the electric field strength at radial distance r in the plane that bisects the rod.



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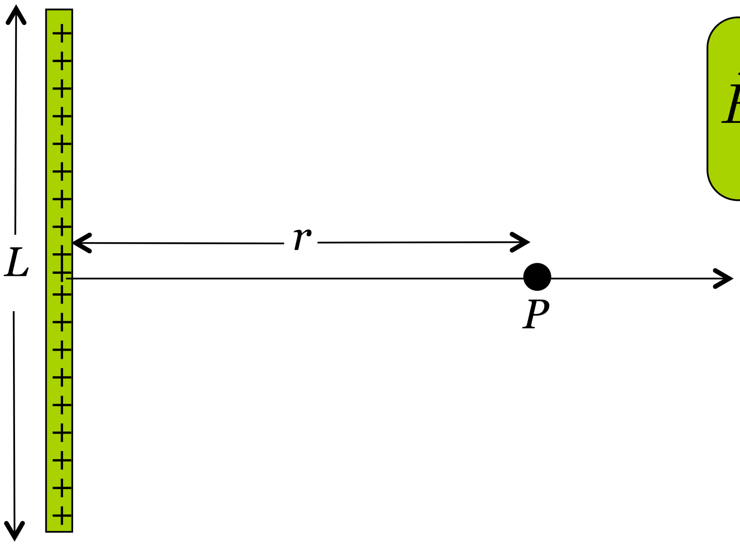
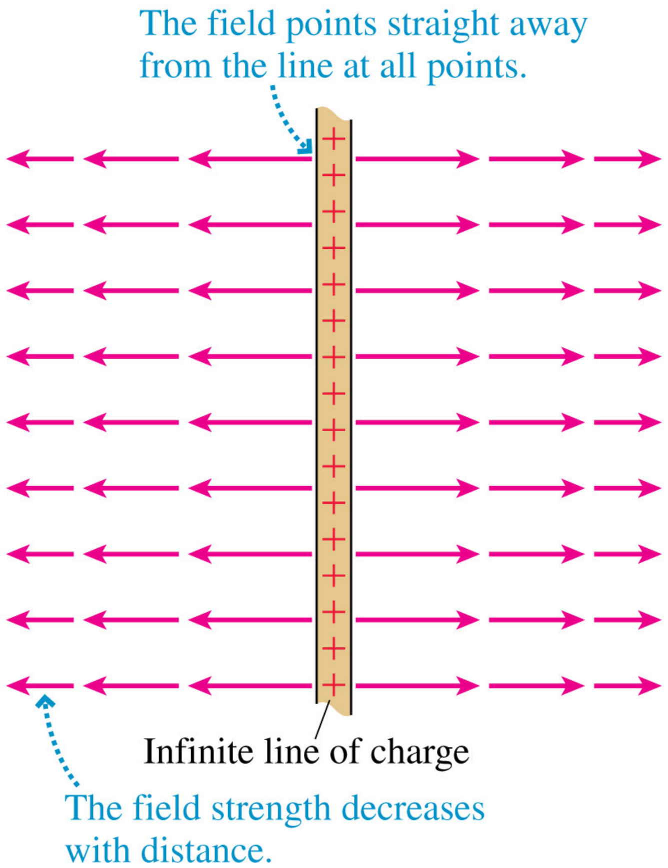


$$\vec{E}_{rod} = \frac{1}{4\pi\epsilon_0} \frac{Q}{r\sqrt{r^2 + L^2/4}} \hat{\imath}$$

- Q: What if the rod becomes *infinitely* long?

E-field of a line of an infinite line charge..



$$E_{line} = \frac{1}{4\pi\epsilon_0}\frac{2\lambda}{r}$$